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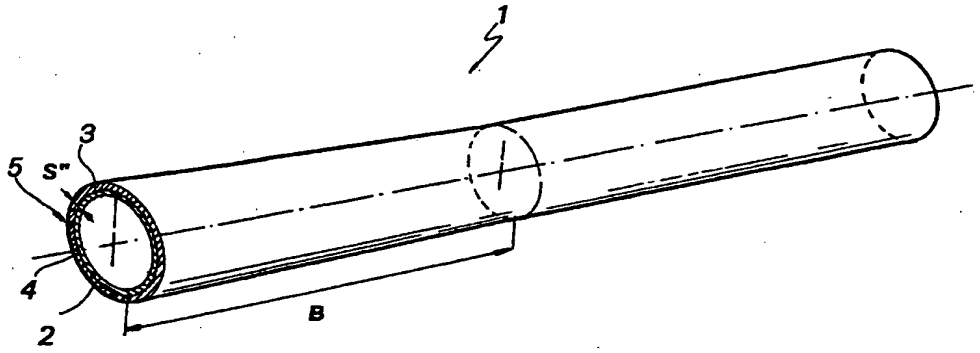
(54) Title: REINFORCED FLEXIBLE HOSE AND METHOD FOR THE PRODUCTION THEREOF



(57) Abstract: A reinforced flexible hose (1) comprising at least a first inner extruded tubular layer (3) and at least a second extruded tubular layer (2) with a tubular reinforcement fabric (4) provided between said first (3) and second (2) hoses. The two tubes are joined so as to form a homogeneous unit by their mutual contact surfaces, by gluing or molecular adhesion for example. The end portion of the hose (1) increases in width so much as to make it possible to achieve a better mechanical hold with the standard junctions to which it is bound to be fixed. The thickness increases at the end portions may either be constant along its whole length, or start gradually toward the end.

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"REINFORCED FLEXIBLE HOSE AND METHOD FOR THE PRODUCTION THEREOF"

FIELD OF THE INVENTION

The present invention relates to a reinforced flexible hose, particularly but not exclusively suitable for the field of gardening.

BACKGROUND OF THE INVENTION

Flexible hoses are known which belong to the cheap category of the market. In order to control production costs, these are produced joining two coaxial tubular layers having reduced thickness, by means of the insertion of a knitted or woven reinforcement therebetween.

The above mentioned types of hoses are usually employed in connection with mounts, joints or irrigation tools having standard size and manufactured on a mass scale. Tubes having a reduced thickness are hard to join to the standard quick-fit joints, therefore a short while after the hose starts being used, water leaks are often found to occur through the joining area.

A further disadvantage of said known hoses is that they are prone to be easily twisted and damaged where they connect with the joint, most often in proximity of the water mains tap.

Several attempts to overcome the above shortcomings were made in the past, for instance fixing joints that are pressed and made to be suitable for the hose either at the production stage or resorting to hose joints to be fixed between the hose and the standard joint, said hose joints being made of a similar material to that the tube is made of and further being suitably secured.

Although on the one hand the above solutions lead to a reinforcement of the hose wall, thus making its bending more difficult, on the other hand they bring about an increase in production costs, that makes them not too favourably welcomed by the users of this specific market.

A further disadvantage is that in case the hose breaks and is subject to shortening at its end portions, it turns out to be mandatory to use standard joints that have the known sealing problems deriving from the difficulty there is to find special joints distributed by the normal large-scale retail trade.

In case reinforcements are made by hose joints, it is likewise difficult to find spare hose joints to replace those that cannot be recovered after a damaged hose has been shortened.

SUMMARY OF THE INVENTION

A primary object of the present invention is to provide a new type of hose that is capable of being easily and effectively joined to the standard joints, in so doing maintaining its enhanced sealing properties and avoiding water leaks, while retaining its cost effectiveness at the production stage and remaining comprised in the low-cost category on the market.

A further specific object of the present invention is to design a hose of the type outlined above that features a structure that is capable of minimising the risks of breakage, twisting or detachment at the joining with the tap or with the watering tool.

The above objects are accomplished by providing a reinforced flexible hose that comprises at least one first extruded tubular layer provided internally of at least one second tubular extruded layer, a tubular reinforcement of a textile fabrics

material provided between said first and said second layers, said layers being joined in correspondence of their mutual contact surfaces, wherein an end portion of the hose has an increased thickness along a predetermined length.

Thanks to said reinforcements, it is thus possible to use joints of the standard type, maintaining a mechanical connection at the reinforced end of the hose, preventing the hose to detach from the joint and reducing the danger of twisting the end portion thereof during handling by the user.

A further object of the present invention is to provide a simple method for the production of a hose according to the present invention, that allows the production of great quantities thereof on a continuous basis at low costs, by using the existing equipment, though suitably modified for that purpose.

The above object is accomplished by providing a method for the production of a reinforced flexible hose according to the present invention, characterised in that it comprises the following steps:

a) extrusion of at least one first tubular layer of plastic material having a predetermined thickness and a predetermined advancement speed;
b) weaving a tubular reinforcement on the outer surface of said first layer, with said predetermined advancement speed,
c) extrusion of at least one second tubular layer made of plastic material all around said first layer as well as of said tubular reinforcement, so as to allow a homogeneous joining therebetween, at substantially the same advancement speed;
d) formation on said first and/or on said second tubular layers of longitudinal portions having increased thickness so as to enhance the intrinsic resistance of the hose in order to enhance stable attachment thereof to end joints and/or other irrigation

accessories;

e) cutting the hose in the over of increased thickness.

Step d) can be accomplished by varying the advancement speed of at least one of the said layers in correspondence at said longitudinal portions thereof having greater thickness. The speed change can be accomplished either in a gradual fashion so as to increase the hose thickness along a portions of its length, or instantaneously, then the speed is kept at a constant value for a portion of its length.

As an alternative, step d) can also be accomplished by varying the flow of the extruded material having increased thickness.

The finished hose alternatively features end-longitudinal portions having increased thickness and being frusto-conically shaped as with their larger side in common, or it may otherwise feature a cylindrically shaped thicker portion.

At the end of the process, the hose is cut in correspondence of the section having maximum diameter or of the middle area of the portion having increased thickness.

BRIEF DESCRIPTION OF THE DRAWINGS

Further features and advantages of the present invention will be more clearly apparent in the light of the following description of a preferred but not exclusive embodiment, given by way of not limiting example, of a reinforced flexible hose illustrated in the attached drawings, wherein:

fig. 1 shows a longitudinal section view of the hose of the prior art,

fig. 2 is a cross-sectional view of the hose shown in Fig. 1.

fig. 3 is a general perspective view of an embodiment of the reinforced

flexible hose according to the present invention;

fig. 4 is a longitudinal sectional view of a first embodiment of the present invention;

fig. 5 is a general perspective view of a second embodiment of the reinforced flexible hose according to the present invention;

fig. 6 is a cross sectional view of the embodiment of flexible hose shown in Fig. 5;

fig. 7 is a cross sectional view of the hose shown in Fig. 6;

fig. 8 is a schematic side view of a device for the production of a hose according to the present invention, with said device in a first operating position;

fig. 9 is a schematic side view of the device shown in Fig. 8, with said device in a second operating phase.

DESCRIPTION OF SOME PREFERRED FORMS OF EMBODIMENT

With reference to Figs. 1 and 2 a flexible hose of the prior art is shown, generally indicated with the reference numeral 1, that is essentially formed by two tubular coaxial layers, respectively an inner layer having an inner diameter Di and an outer layer having an outer diameter De, and with a tubular reinforcement or stock 4 made of fibrous material, of the woven or knitted type, that is interposed between the two layers 2, 3 and extends over the entire length thereof.

Layers 2, 3 are made of extruded plastic materials and are mutually joined in correspondence of their mutual contact surface with the interposition of reinforcement 4 so as to form a wall having an overall thickness S that is substantially constant, except the working tolerances connected with the extrusion of layers with the weaving of the reinforcement fabrics 4.

Figs. 3 and 4 show a first embodiment of hose 1 according to the present

invention, said hose having a thickness S' along a portion A of its length starting at one end 5, said thickness being increased with respect to thickness S of the portion of hose 1 that is the furthest from its end 5.

In this first embodiment, tube wall 1 has either a substantially constant thickness along the whole portion A past circular step 6 or an extremely short conical connecting portion. Thus it will be possible to promote a stable watertight mating with connecting organs or gardening hose joints, thereby avoiding water leakages and any sort of breakages at those hose joints.

According to a second embodiment of the reinforced flexible hose of the present invention, illustrated by Figs. 4, 5 and 6, the increase in thickness of the hose wall is accomplished by a gradual increase in thickness of the outer layer 3 starting from point 6 where the wall has a thickness that is equal to the average normal thickness S. Therefore thickness increases in a linear fashion until it reaches a maximum value S" in correspondence of end 5. This is accomplished by means of an increase in thickness limited to the outer layer 3.

In general, longitudinal portions A and B having increased thickness allow the accomplishment of a stable mechanical grip with standard joints or irrigation tools and accessories of the threaded ferrule type, that has an enhanced mechanical and hydraulic resistance where the hose has a greater thickness.

In view of the fact that the greatest stresses caused by the user's handling are localised where the joints are coupled to the hose, the reinforcement according to the present invention brings about a reduction in the ease with which the hose bends and twists, with a further advantage for the user.

Layers 2, 3 that form the hose can be made of the same or of different materials, in accordance with the technical and aesthetic requirements to be

met. The inner tubular layer can for instance be made of a material that is suitable for allowing contact with food or beverage products without releasing dangerous or harmful particles, whereas the outer layer can be made of a less noble material that is very unsuitable for alimentary use.

It is also possible to envisage further outer layers or films made of materials with anti-abrasive properties, or likewise being shielding against ultraviolet (UV) radiation, that have purely ornamental and aesthetic, with various different uniform or patterned colourings and pigmentations.

According to the present invention, reinforcement 4 can also be laid over exclusively one extruded tubular layer rather than being interposed between two co-extruded layers, if and whenever appropriate.

Furthermore it is possible to form the increased thickness exclusively on the inner tubular layer 2, as well as it is possible to provide the increased thickness of both layers in correspondence of the same area.

In Figs. 8 and 9 a machine for the production of a plastic hose extrusion according to the present invention is schematically depicted, that is part of a full production line for the flexible hose.

In Fig. 8 an intermediate product is shown and indicated with the reference numeral 1, said product consisting of the inner tubular layer 2, whereon the woven or knitted tubular reinforcement fabric 4 is formed.

The semi-finished product 1' is guided by rollers 7, 8, 9 up to an extrusion head 10 that forms the outer tubular layer 3 coaxially to the product 1'. For a first embodiment, the flow Q of the material extruded from head 9 is constant and the thickness of the extruded tubular layer 3 deposited around product 1'

depends on its advancement speed V within head 10. Advancement speed V of finished tube 1 is generally constant at the very end of the production process, therefore a decrease ΔV in the speed is accomplished combining the actuation of roller groups 7, 8 and 9 and 11, 12, 13 accompanying the hose. In particular, moving downwards the roller 8 located upstream of the extrusion head 10 and moving upwards the roller 12 located downstream of the extrusion head 10, until positioning them as shown in Fig. 8, the length of the path the tube must move along is varied, thereby reducing its velocity from V to $V - \Delta V$ in correspondence with head 10.

A change in speed ΔV can then be accomplished either gradually or instantaneously, depending on the configuration the portion with increased thickness must have. Applying a suitable algorithm to the change in advancement speed, end portions with an increased thickness can be shaped differently.

In a second embodiment of the production method according to the present invention, it is possible to accomplish an increase in thickness by a variation ΔQ of extruded material flow Q, deposited by the extrusion head 10.

Downstream of the extrusion head 10 there may also be provided a container 14 wherein the finished hose 1 that is still warm can be subjected to further working process, or be simply allowed to cool down.

The production of the hose is carried out on a continuous basis and the length of the end portions where the increased thickness of the hose wall are formed is defined as a function of the overall length of the hose to be produced. When the production of a first batch is over, the segments of hose are severed at the middle point of their thickened portion. In order to identify the point where the tube is to be cut, the pigmentation and colouring of the outer layer of the

finished hose may be varied. Such pigmentation and colour may be varied along the end portions in order to produce hoses having longitudinal portions with a different colour, so as to easily highlight the area where variations in thickness occur. To this end, it is likewise possible to carry out the injection of pigmented material having different colours through head 10.

The overall colouring of the hose, that is of its outer layer, and possibly as well as of the woven reinforcement fabrics can be accomplished with materials that are either uniformly coloured or that are striped, using the same or different colours. Colour combinations are also possible in so doing obtaining a wide range of aesthetic, optical and visual effects.

CLAIMS

1. Multiple layer reinforced flexible hose comprising at least one first inner tubular layer (2) made of extruded plastic material, at least one second outer tubular layer (3) made of extruded plastic material, a tubular reinforcement (4) made of a textile material interposed between said first (2) and said second (3) layer, said layers (2, 3) being homogeneously joined in correspondence of their mutual contact surface so as to define a wall having an overall predetermined thickness (S), wherein an end portion of said wall has an increased thickness along longitudinal portions (A, B) having predetermined extensions to thereby provide watertight sealing action with external connection organs.

2. Reinforced flexible hose according to claim 1, characterised in that said increased thickness (S') is only localised on said outer tubular layer (3).

3. Reinforced flexible hose according to claim 1, characterised in that said increased thickness (S') is only localised on said inner tubular layer (2).

4. Reinforced flexible hose according to claim 1, characterised in that said increased thickness (S') is localised on both said outer tubular layer (3) and said inner tubular layer (2).

5. Reinforced flexible hose according to claim 1, characterised in that said increased thickness is substantially constant along the whole extension (A) of said longitudinal portions.

6. Reinforced flexible hose according to claim 1, characterised in that said increased thickness increases gradually towards the free end of said

longitudinal portions (B).

7. Reinforced flexible hose according to claim 1, characterised in that said increased thickness increases non-linearly towards the free end of said longitudinal portions.

8. Reinforced flexible hose according to anyone of the preceding claims characterised in that said first (2) and said second layers (3) are coloured with different pigmentations along their whole extension or along parts thereof.

9. Reinforced flexible hose according to claim 8, characterised in that said pigmentations and colourings are substantially uniform and they are differentiated in correspondence of the thickness change of said longitudinal portions (A, B) with predetermined extension.

10. Reinforced flexible hose according to anyone of the preceding claims, characterised in that it comprises one or more further inner, outer or middle tubular layers, made of plastic material, having technical and/or aesthetic functions.

11. Reinforced flexible hose according to claim 10, characterised in that said one or more further plastic material layers are chosen in the group comprising food compatible, anti abrasives, UV shielding and ornamental films.

12. Method for the production of the flexible hose according to anyone of claims 1 to 11, characterised in that it comprises the following steps:

a) extrusion of at least a first inner tubular layer (2) made of plastic

material having a substantially constant advancement speed (V);

b) weaving textile fabrics material (4) onto the outer surface of said first layer (3), at the same advancement speed;

c) extrusion of at least a second tubular layer (2) made of plastic material at substantially the same advancement speed, on said first layer (2) and said tubular reinforcement (4) so as to allow a homogeneous fitting of said layers (2, 3) so as to form a wall having a predetermined thickness (S);

d) production of longitudinal portions (A, B) having an increased thickness (S', S") in said first and/or second tubular layer (2,3) so as to enhance resistance of the hose in order to favour a stable mating to hose end joints or to other irrigation accessories;

e) cutting the hose in correspondence of said longitudinal portions (A,B) having increased thickness.

13. Method according to claim 12, characterised in that said step d) is accomplished by means of a change (ΔV) in the advancement speed (V) for at least one of said layers (2, 3) in correspondence with said layers (A, B) having increased thickness.

14. Method according to claim 13, characterised in that the change (ΔV) in advancement speed is accomplished in a gradual fashion so that the thickness of said wall linearly increases along said longitudinal portions (B) having a length reaching a maximum predetermined value (S").

15. Method according to claim 13, characterised in that the change (ΔV) in advancement speed is carried out instantaneously and it is subsequently reduced to zero along longitudinal portions (A) having a predetermined

length such that they increase the thickness (S) in said longitudinal portions of the hose (1) up to a maximum predetermined value (S').

16. Method according to claim 12, characterised in that said phase d) is accomplished by a change (ΔQ) in the flow (Q) of extruded material in correspondence of the increase in thickness.

17. Method according to anyone of claims 12 to 16, characterised in that said phase d) is accomplished by thickening only said first inner layer (3).

18. Method according to anyone of claims 12 to 16, characterised in that said phase d) is accomplished by thickening only said second outer layer (2).

19. Method according to anyone of claims 12 to 16, characterised in that said phase d) is accomplished by thickening both said inner (3) and said outer (2) layers.

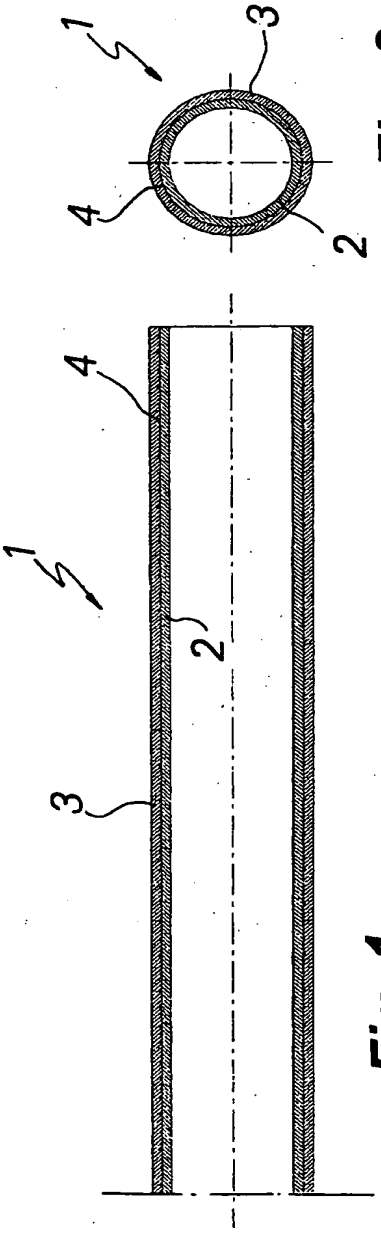

Fig. 1

Fig. 2

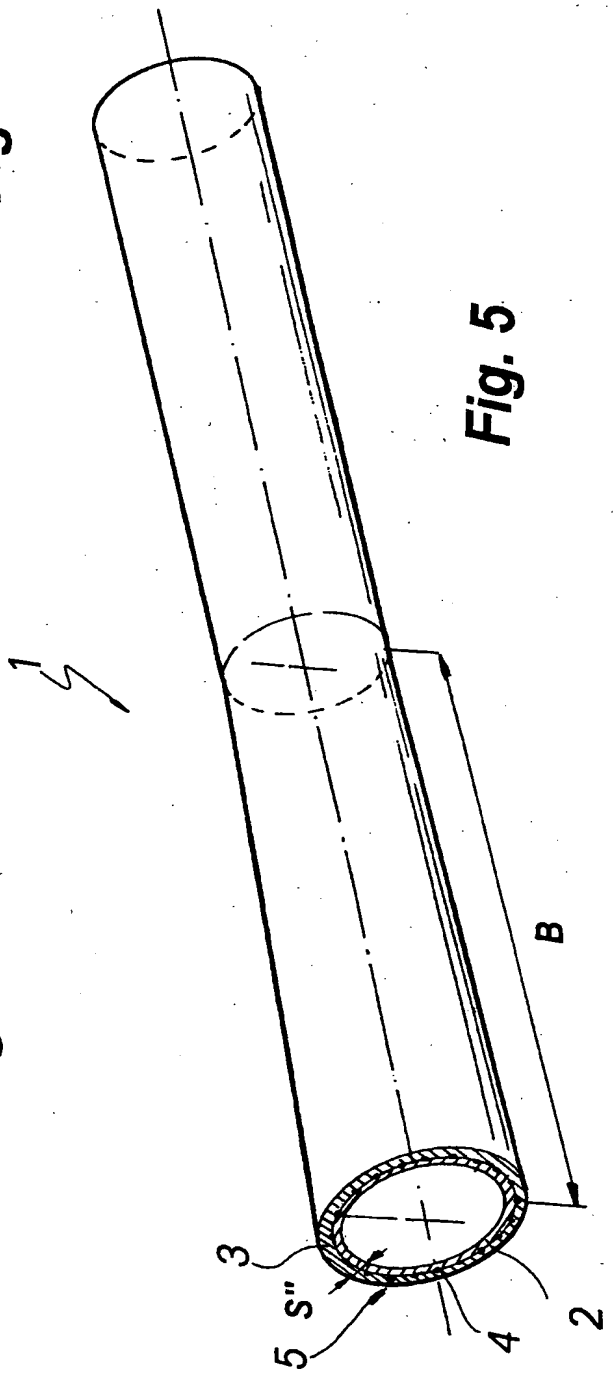

Fig. 5

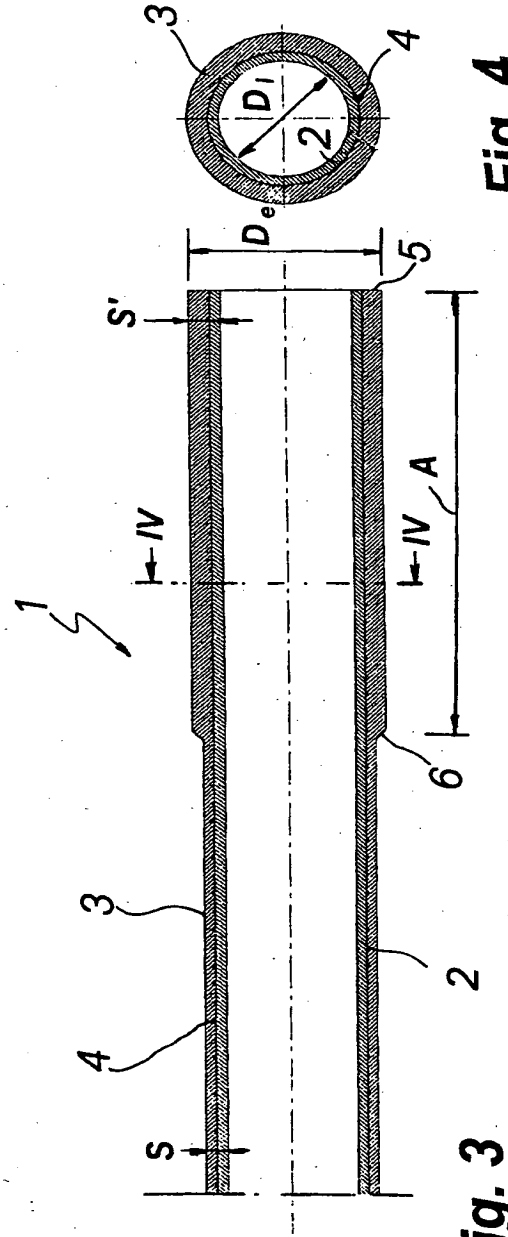

Fig. 4

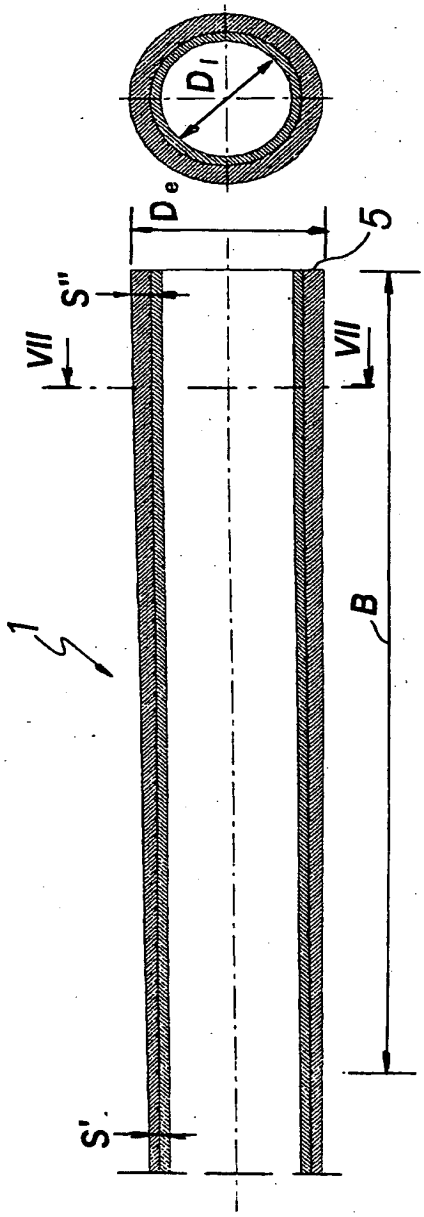

Fig. 7

Fig. 3

Fig. 6

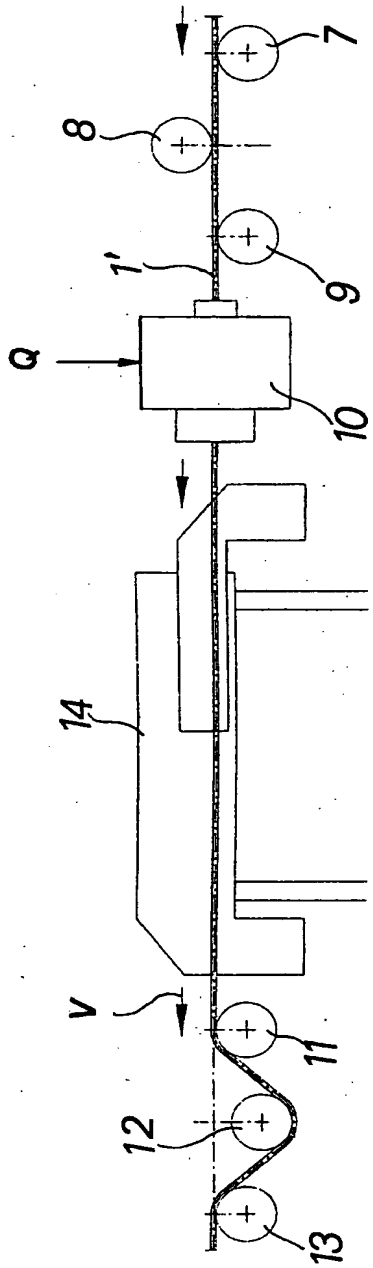

Fig. 8

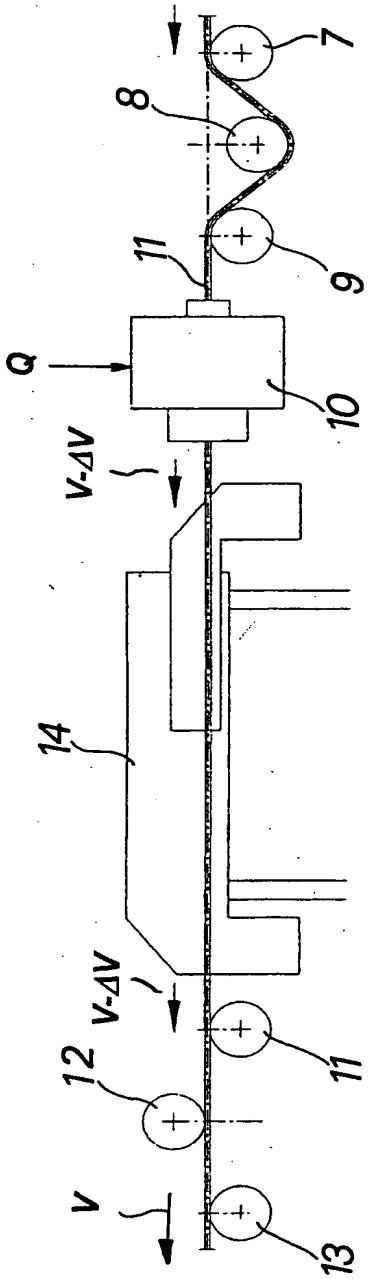

Fig. 9

INTERNATIONAL SEARCH REPORT

Ir ational Application No
PCT/IB 00/00778

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16L11/12 F16L35/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B29C F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y A	DE 11 65 947 B (WETZELL GUMMIWERKE AG) 19 March 1964 (1964-03-19) column 1, line 1 -column 3, line 36; figures	5 1-3,15
Y A	US 5 332 160 A (RUSKIN RODNEY R) 26 July 1994 (1994-07-26) column 2, line 7 - line 35 column 3, line 63 -column 4, line 12; figure 4	8-11 1,12

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
5 September 2000	12/09/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Axelsson, T

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB 00/00778

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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